November 29, 2004

By Electronic Filing

Marlene Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20054

Re: Comments on Petition for Rulemaking - Amendment of Part 15 Rules for License-Exempt 57-64 GHz Band
RM–11104

Dear Ms. Dortch:

As the former Chairman of the Millimeter Wave Communications Working Group ("MMWCWG") and a supporter since 1994 of unlicensed 60 GHz radio, I am writing to comment on the Petition for Rulemaking filed by the Wireless Communications Association International ("WCA") proposing to modify rules for the 57-64 GHz band ("60 GHz").[1] I believe the proposed rule changes would undermine the intent of the Commission in developing the 60 GHz rules and would not be in the public interest. For this reason, I request that the Commission deny WCA's petition for rulemaking.

By way of background, the MMWCWG was an industry group formed in the mid-1990s to recommend to the Commission guidelines for use of the 60 GHz band. In 1996-97, the MMWCWG worked in open meetings to develop a consensus on the best use of 60 GHz, both for the industry and the public at large. In 1996, the MMWCWG unanimously provided to the Commission recommendations designed to enhance the use of the band for a wide variety of users and mitigate interference. In June 1998, the Commission adopted MMWCWG's recommendations.

[1] I currently serve as a project manager for Agilent Technologies.

Although at present there is limited use of 60 GHz, I expect that this next decade will bring many more users to the band.[2] For this reason, and because I believe the Commission's rules are sound and should continue to apply to 60 GHz, I am providing the following comments on WCA's rulemaking request.

**A. The Commission Need Not Change The Existing Power Density Limits Of Section 15.255(b) to EIRP Units.**

The Commission need not add an EIRP-based limit to the existing power density limits of Section 15.255(b), as requested by WCA. The Commission's entire unlicensed radio rule regime allows measurement of transmitter strength by either power density ("PD") or Equivalent Isotropic Radiated Power ("EIRP"). The equivalence between the two systems of units is well understood.

As a point of clarification, contrary to the statements of WCA,[3] the Commission did not determine its Section 15.255 Power Density limits based on radiation exposure concerns. The present PD was set in the Commission's 1995 Report and Order that opened 60 GHz to unlicensed use, and the Commission did not set radiation exposure limits until a later proceeding.[4] The Commission set the 18uW/cm^2 peak power density limit, upon recommendation of MMWCWG, based on a concern for potential interference among unlicensed devices in the band. The 500 mW (27 dBm) maximum power limitation was set, upon recommendation by MMWCWG, with the intention that omni-directional base stations might require such high transmitter powers in order to meet the allowed PD limits.

Second, the present rules allow for 60 GHz transmitters to be type-certified with measurements made in the far field. The WCA, thus, is inaccurate in stating that spectrum users must "comply with power density ("PD") limits measured in the near field."[5] Rather, power density rules are set out in Section 15.31(f)(1).[6] This rule is clear that measurements are not required to be made in the near field.[7] For this reason, there is no need to modify Section 15.255.

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[2] Partly, this is due to the economic downturn of the past few years and partly it is due to the high cost of building 60 GHz radios with 1990s technology. Both these situations are changing. Interesting progress in the use of low-cost CMOS for 60 GHz radios is now being made at universities in the U.S. and Canada. There is a good chance that this technology could result in low-cost 60 GHz radios within the decade. On the regulatory front, many authorities around the world have now recognized the benefits of low-power, unlicensed 60 GHz radios.

[3] *Amendment of Part 15 Rules for License-Exempt 57-64 GHz Band*, Petition for Rulemaking at 8-9 (filed Sept. 30, 2004) ("Petition for Rulemaking").

[4] *In the Matter of Amendment of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Order and Second Notice of Proposed Rulemaking, 11 FCC Rcd. 4481, 4498-99 (1995).

[5] Petition for Rulemaking at 2.

[6] 47 C.F.R. § 15.31(f)(1).

[7] *Id.* (stating that "measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristic of the device.").

I note that there are licensed services available to the wireless community in other millimeter wave bands, such as 71-76 GHz, 81-86 GHz and 92-95 GHz, that allow for use of high power, point-to-point transmitters. Given that 13 GHz bandwidth therefore is available for licensed millimeter wave usage, there is no need for even higher-powered point-to-point links in 60 GHz, an unlicensed band, and no need to initiate a rulemaking to change the measurement protocol. Such a rule change would be inconsistent with future, widespread unlicensed use of the band.

**B. The Proposed Increase In EIRP Would Create Interference Problems Without Providing Any Significant Improvement In Service.**

The Commission should not change the existing power limits, as the proposed request would create interference problems without providing any significant improvement in service. WCA requests the Commission increase the maximum allowable EIRP limits from 40 dBm to "82 dBm reduced by a factor of 2 dB for every dB that the transmit antenna far-field gain is less than 51 dBi."[8]

This is equivalent to increasing the EIRP from 10 W to up to 63,000 W, 200 times greater than what currently is allowed.[9] Although this increase will allow the communications range to double, it also will nearly double the interference range, bringing it to an unacceptable level.[10] Point-to-point links can cause interference well beyond their link range and, while the nature of the frequencies in this band ameliorates this problem with oxygen absorption, the potential for interference remains high. If the 60 GHz band is to be preserved for widespread unlicensed use, as was intended by the Commission, the Commission should take every precaution not to permit the proliferation of high-powered links in the band.

Additionally, there is no need for this increased EIRP because the practical value of increasing the link range is debatable and because WCA's claim that this rule change will open the band to broadband access is dubious. As detailed in Attachment A, in New York City, where adjacent high-rise buildings can easily be accessed with the present 308m range, the proposed 645m range is only marginally more useful. And in a city such as Washington, DC, the proposed 645m range is not competitive with existing microwave point-to-point links.

The intent of the Commission in developing the current 60 GHz rules was to preserve the band for short, point-to-point links at low power levels. Longer ranges are more appropriate in other millimeter wave bands that are licensed. For example, because of its lack of oxygen absorption, the 71-76 GHz band offers greater range for a given power than 60 GHz. Moreover, the 71-76 GHz rules require that this is a licensed band that requires specific antenna characteristics to minimize the chance of interference in both

[8] Petition for Rulemaking at Ex. 1 (Proposed Rule Changes).
[9] *See* Attachment A.
[10] *Id.*

the main lobe and sidelobes. Thus, there are more appropriate options available for millimeter-wave broadband point-to-point links, and there is no need to change the intended character of the 60 GHz band for such use.

Finally, as the Commission noted in its 1995 rulemaking, it would require "a significantly more detailed plan for protecting against RF exposure" before allowing higher power levels for unlicensed millimeter-wave devices.[11] The rule changes proposed by WCA do not offer such a plan, reason enough for the petition to be denied.[12]

### C. Window Links Create A Significant Interference Risk and Should Not be Exempt From Transmitter Identification Requirements.

The Commission should not grant the WCA's request to exempt window-mounted, point-to-point links from call sign requirements. This proposal ignores the serious potential for interference created by high power transmitters located indoors. Uncoated window glass reflects about 4% of radiated power incident on it. This means that the outgoing beam will scatter a reflected wave only 14 dB weaker than the transmitted wave back into the building, and the receivers in the transmitter's building could well receive a stronger signal than in the receiving building. For buildings with coated window glass, the reflection coefficients could be even higher and the transmission even lower.

Given the WCA's request for ultra-high power transmitters, its request for waiver of the call-sign requirement, coupled with a lack of installation and shielding rules, sets the stage for interference problems for indoor unlicensed devices. Again, the 71-76 GHz is the more appropriate band for this type of usage. As well, implementing the call sign requirement is neither expensive nor complicated. For these reasons, and because it is not possible to ascertain at type certification whether a transmitter will be used as a "window transmitter", the transmitter identification requirement should be retained for all indoor communicators, whether or not located in a window.

### D. Conclusion

As noted above, there will be increased demand for 60 GHz use in the coming years. The Commission should continue to focus on the future use of this band and adopt policies that will protect all users from interference. The Commission's present rules are a means to do just this. WCA's proposed changes to the 60 GHz rules would discourage widespread unlicensed use of the spectrum including development of innovative 60 GHz products. Accordingly, the Commission should deny WCA's petition for rulemaking.

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[11] 11 FCC Rcd. at 4499.

[12] For example, Exhibit 2 of WCA's petition shows that with a 27 dBm transmitter, antenna diameters less than 16 inches exceed the present radiation exposure limit of 1 mW/cm^2 specified in the 1995 Report and Order. *See* 11 FCC Rcd. at 4498-99.

I would be glad to provide the Commission with additional information regarding this matter.

Sincerely yours,

/s/ Rory Van Tuyl

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# Attachment A

WCA asks for an increase in EIRP limits from 40 dBm [10W] to "82 dBm less 2 dB for every dB that antenna gain is below 51 dBi." As shown in the following table, this allows for increase of both antenna gain and transmitter power up to an EIRP of 63,000 W, 200 times greater than what is allowed in, for example, the 71-76 GHz *licensed* band:

| **Antenna Gain** | **EIRP Limit** | **Transmitter Power** |
|---|---|---|
| 30 dBi | 40 dBm [10W] | 10dBm |
| 40 dBi | 60 dBm [1000W] | 20dBm |
| 51 dBi | 78dBm [63,000W] | 27dBm |

For a gigabit communication link [BW=1250 MHz], the range with the present 10 W EIRP is compared to the WCA example of 1000 W EIRP in the following table:[1]

| **City** | **Range with 10W EIRP** | **Range with 1000W EIRP[2]** |
|---|---|---|
| San Diego | 400m | 915m |
| New York City | 308m | 645m |
| New Orleans | 260m | 522m |
| Interference Range (all cities)[3] | 1250m | 2200m |

The communication range will approximately double, but so will the interference range. The practical value of increasing link range in, say, New York City from 308m to 645m is debatable. Adjacent high-rise buildings can easily be accessed with a 308m range [approximately 1000 feet], while a 645m range is only marginally more useful. In a city like Washington, DC, a range of 645m [2100 ft] is not really competitive with existing microwave point-to-point links.

Also, the interference range in dry air is nearly doubled. Point-to-point links can cause interference well beyond their link range. While the 57-64 GHz band ameliorates this problem with oxygen absorption, the potential nonetheless exists.

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[1] These calculations assume a receiver sensitivity of –90 dBm, which is consistent with a 5 dB noise figure and 1250 MHz bandwidth, assuming a receive antenna gain of 32 dBi, and a 20 dB S/N ratio requirement.

[2] WCA cites the example of a 12 inch antenna with a 17-22 dBm transmit power. The gain at 60 GHz of a 12-inch antenna is approximately 43 dBi. Thus the EIRP limit would be 82-2*(51-43)=66 dBm, or 4000 W. So the maximum transmitter power would be 66-43=23 dBm. With Transmitter Power=17 dBm, EIRP would be 17+43=60 dBm=1000 W.

[3] The interference range is calculated for dry air, assuming that a competing signal 20 dB below the receiver sensitivity could cause interference.